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Paper 9
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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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JUNIPER NETWORKS, INC., NOKIA CORP. AND
NOKIA OF AMERICA CORP.,
Petitioner,

v.

CORE OPTICAL TECHNOLOGIES, LLC,
Patent Owner.

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IPR2020-01664
Patent 6,782,211 B1

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Before KEN B. BARRETT, PATRICK M. BOUCHER, and MELISSA A. HAAPALA, *Administrative Patent Judges*.

BARRETT, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
*35 U.S.C. § 314*

# I. INTRODUCTION

## *A. Background and Summary*

Juniper Networks, Inc., Nokia Corp., and Nokia of America Corp. (collectively, "Petitioner")[1] filed a Petition requesting *inter partes* review of U.S. Patent No. 6,782,211 B1 ("the '211 patent," Ex. 1001). Paper 1 ("Pet."). The Petition challenges the patentability of claims 30, 32, 33, 35, and 37 of the '211 patent. Core Optical Technologies, LLC, ("Patent Owner")[2] filed a Preliminary Response to the Petition. Paper 8 ("Prelim. Resp.").

An *inter partes* review may not be instituted "unless . . . the information presented in the petition . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a) (2018). Having considered the arguments and evidence presented by Petitioner and Patent Owner, we determine that Petitioner has not demonstrated a reasonable likelihood of prevailing on at least one of the challenged claims of the '211 patent. Accordingly, we do not institute an *inter partes* review of the challenged claims.

## *B. Related Proceedings*

One or both parties identify, as matters involving or related to the '211 patent, *Core Optical Techs., LLC v. Juniper Networks, Inc. et al.*, 8:19-cv-02189-JAK-RAO (C.D. Cal.), *Core Optical Techs., LLC v. Nokia Corp.*

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[1] Petitioner identifies Juniper Networks, Inc., Nokia Corp., Nokia of America Corp., and Alcatel Submarine Networks as real parties-in-interest. Pet. 76.

[2] Patent Owner identifies itself, Core Optical Technologies, LLC, as the real party-in-interest. Paper 5, 1.

*et al.*, 8:19-cv-2190-JAK-RAO (C.D. Cal.), *Core Optical Techs., LLC v. Cisco Systems et al.*, 8:20-cv-01468 (C.D. Cal.), *Core Optical Techs., LLC v. ADVA Optical Networking SE et al.*, 8:20-cv-01463 (C.D. Cal.), and Patent Trial and Appeal Board cases IPR2016-01618 (US 6,782,211 B1) and IPR2018-01259 (US 6,782,211 B1). Pet. 76–77; Paper 5, 1. Petitioner also identifies other district court actions involving the '211 patent. Pet. 77.

### *C. The '211 Patent*

The '211 patent pertains to fiber optics and describes a cross-polarization interference canceler ("XPIC") that enables reconstruction of two optical signals transmitted with generally orthogonal polarization states in the same frequency band. Ex. 1001, 1:12–14, 3:10–18. During propagation through an optical fiber, the orthogonality of two optical signal fields is lost to some extent, resulting in cross polarization interference ("XPI") at the receiver. *Id.* at 2:43–48. The XPIC mitigates dispersion effects and loss of optical field orthogonality incurred during propagation through the optical fiber. *Id.* at 1:12–19.

Figure 3 of the '211 patent is reproduced below:

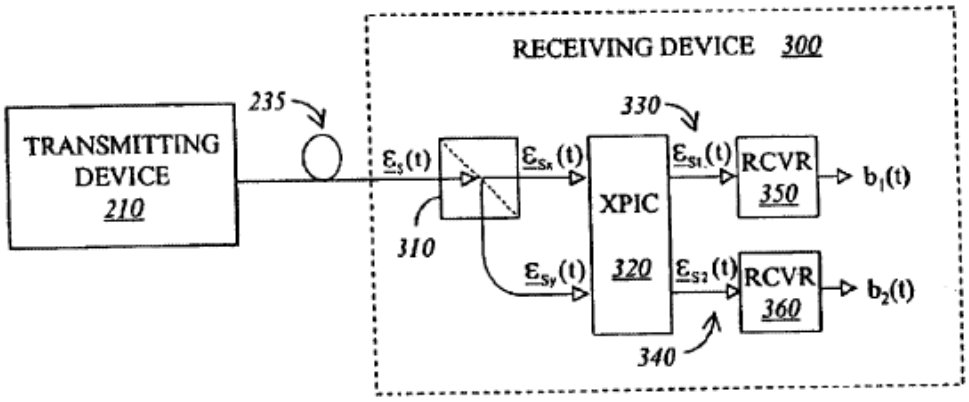


Figure 3 is an illustrative embodiment of a device utilizing an optical XPIC. *Id.* at 7:1–2. Transmitting device 210 produces two modulated optical signals with orthogonally polarized electric fields that are transmitted over

optical fiber 235 to receiving device 300. *See id.* at 4:56–66, 5:18–21. The optical system is modeled mathematically using matrices. *See id.* at 5:39–7:57. Receiving device 300 includes polarization beam splitter 310 and optical XPIC 320. *Id.* at 7:2–5. Polarization beam splitter 310 separates the received optical signals into its two components, which are processed by XPIC 320 and the outputs are routed to standard intensity modulation direct detection (IM-DD) fiber optic receivers. *Id.* at 7:5–11. XPIC 320 may be a diagonalizer that diagonalizes the overall link transmission matrix to eliminate XPI and dispersion effects. *See id.* at 7:58–8:57.

The '211 patent describes additional exemplary embodiments in which the XPIC is implemented optically or electrically. *See id.* at Figs. 5, 6, 9, 4:32–34, 4:45–51. In, for example, the embodiment of Figure 5, coherent heterodyne receivers rather than IM-DD receivers are used, and the optical XPIC output fields are routed to double balanced optical receivers (DBORs), which produce a current, and those outputs are routed to demodulators. *Id.* at 9:20–36. Additionally, the '211 patent describes that the XPIC may provide a minimum mean square error ("MMSE") solution. *See id.* at 16:21–27.

### *D. Illustrative Claim*

Of the challenged claims of the '211 patent, claims 30, 33, 35, and 37 are independent claims. The remaining challenged claim, claim 32, depends directly from claim 30. Claim 30, reproduced below with bracketed annotations[3] inserted, is illustrative.

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[3] We utilize Petitioner's annotations for claim 30 but have retained the paragraph formatting from the issued patent.

> 30. [Pre] A method comprising:
>
> [a] receiving an optical signal over a single fiber optic transmission medium, [b] the optical signal being one or more polarized field components independently modulated with independent information bearing waveforms; and
>
> [c] processing the optical signal by (i) separating the optical field of the optical signal into orthogonally polarized field components, [d] (ii) routing each of the orthogonally polarized field components to a coherent optical receiver to produce a first output and a second output, [e] and (iii) transmitting the first and second outputs to a cross polarization interference canceller (XPIC).

Ex. 1001, 26:1–13 (bracketed annotations added).

*E. Evidence*

Petitioner relies on the following references:

| **Reference** | **Exhibit No.** |
|---|---|
| US 5,388,088; Issued Feb. 7, 1995 ("Gans"[4]) | 1006 |
| S.T. Hsieh *et al.*, *A Comparison of Three Diagonalizers, Adaptive Crosstalk Cancellers, in Dual-Polarized M-QAM Systems*, 39 IEEE TRANSACTIONS ON COMMUNICATIONS, 390 (March 1991) ("Hsieh") | 1007 |
| R.T. COMPTON, ADAPTIVE ANTENNAS: CONCEPTS AND PERFORMANCE (Prentice Hall 1988) ("Adaptive Antennas"[5]) | 1008 |
| US 5,416,628; Issued May 16, 1995 ("Betti '628"[6]) | 1010 |

Petitioner also relies on the Declaration of Dr. Alexander Sergienko (Ex. 1004) and the Declaration of Dr. Jack Winters (Ex. 1031) in support of

[4] Petitioner refers to Gans as "the '088 patent." *See* Pet. 8.
[5] Patent Owner refers to Adaptive Antennas as "Compton." *See* Prelim. Resp. 15; *see also id.* at 32 (referring to the first ground as "Gans + Compton + Hsieh.").
[6] Petitioner refers to Betti '628 as "the '628 patent." *See* Pet. 8.

its arguments. Patent Owner relies on the Declaration of Dr. Joseph Kahn (Ex. 2001), the Declaration of Silvello Betti (Ex. 2003), and the Declaration of Eugenio Iannone (Ex. 2004) in support of its arguments. The parties rely on other exhibits as discussed below.

### *F. Asserted Grounds of Unpatentability*

Petitioner asserts that the challenged claims are unpatentable on the following grounds:

| Claim(s) Challenged | 35 U.S.C. § | Reference(s)/Basis |
|---|---|---|
| 30, 32, 33, 35, 37 | 103(a) | Gans, Adaptive Antennas, Hsieh |
| 30, 32 | 103(a) | Gans, Adaptive Antennas, Hsieh, Betti '628 |

## II. ANALYSIS

### *A. Principles of Law*

Petitioner bears the burden of persuasion to prove unpatentability of the claims challenged in the Petition, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art;

(3) the level of skill in the art; and (4) any objective evidence of obviousness or non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

*B. The Level of Ordinary Skill in the Art*

In determining the level of ordinary skill in the art, various factors may be considered, including the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (internal quotation marks and citation omitted).

Petitioner contends that:

> A [person of ordinary skill in the art] related to the '211 patent would have at least a master's degree in electrical engineering or physics, or an equivalent field, and at least two years of professional or research experience in the field of optical communications systems. EX1004, ¶127. Additional graduate education could substitute for professional experience, or significant experience in the field of optical communications systems could substitute for formal education. *Id*.

Pet. 8; *see also* Ex. 1004 ¶ 127 (Dr. Sergienko's declaration).

Patent Owner does not propose a definition of the level of ordinary skill in the art, and its expert, Dr. Kahn, takes no position on whether Petitioner's expert, Dr. Sergienko, accurately identified the level of ordinary skill in that art. *See* Ex. 2001 ¶27.

For the purposes of this Decision, we apply Petitioner's description of the person of ordinary skill in the art, which we find to be consistent with the level of skill reflected in the '211 patent and the prior art of record.

*C. Claim Construction*

We apply the same claim construction standard used in district courts, namely that articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b) (2019).

In applying that standard, claim terms generally are given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner offers proposed constructions for the terms "cross polarization interference" (XPI), "cross polarization interference canceller" (XPIC), and "diagonalizer cross polarization interference cancellation network." Pet. 18–28. Patent Owner disagrees with Petitioner's proposed constructions and offers its own. Prelim. Resp. 18–24.

On this record and for purposes of this Decision, we determine that no claim terms require express construction.

*D. The Alleged Obviousness of Claims 30, 32, 33, 35, and 37 Over Gans, Adaptive Antennas, and Hsieh*

Petitioner alleges that claims 30, 32, 33, 35, and 37 of the '211 patent would have been obvious over Gans, Adaptive Antennas, and Hsieh. *See* Pet. 29–51 (addressing claim 30).

*1. Gans (Ex. 1006)*

Gans pertains to fiber optic communications and discloses methods for recovering data from optical signals transmitted in different polarizations over the same transmission medium. Ex. 1006, 1:1–11. According to Gans:

> Transmission capacity of an optical fiber is increased by transmitting two optical signals of orthogonal polarizations through the fiber and distinguishing the signals from one another at the receiver by appropriately weighting polarization components representative of the transmitted signals. . . . Signals of arbitrary received polarizations are detected and separated from one another.

*Id.*, code (57) (Abstract).

Gans explains that "multiple fixed polarization filters split the two received optical signals into four polarization components, each of the polarization components being a composite of the two received optical signals." *Id.* at 2:25–29. Each of the four polarization components is converted by the respective one of four photodetectors into an electrical signal. *Id.* at 2:29–31. "The electrical signals are appropriately weighted and combined to produce two output signals." *Id.* at 2:31–33. "The output signals are proportional in magnitude to the two received optical signals and are free of cross-channel interference." *Id.* at 2:21–24.

*2. Adaptive Antennas (Ex. 1008)*

Adaptive Antennas is a textbook with the stated purposes of "present[ing] a unified treatment of adaptive antenna systems and to describe their capabilities and limitations" and of "acquaint[ing] the reader with the analytical techniques used to predict the performance of these systems in new applications." Ex. 1008, 8. "An adaptive antenna is an antenna that controls its own pattern, by means of feedback control, while the antenna operates." *Id.* at 13. "All adaptive antennas to date have been

arrays, rather than continuous aperture antennas, because the pattern of an array is easily controlled by adjusting the amplitude and phase of the signal from each element before combining the signals." *Id.* The book contains a chapter with a section discussing Least-Mean-Square (LMS) adaptive array feedback concepts, including a discussion of an LMS array based on a minimum mean-square error concept. *Id.* at 18–30.

*3. Hsieh (Ex. 1007)*

Hsieh explains that "[t]he diagonalizer and the minimum mean square error (MMSE) canceller are two adaptive receiver structures that reduce the problem of depolarization crosstalk in dually polarized channels." Ex. 1007, 3. Hsieh compares the performance of three different adaptive diagonalizers and concludes that one (the "*D*3" diagonalizer) performed the best and should be compared to the MMSE canceller, which at that time was thought to be substantially better than diagonalizer structures. *Id.* The article also concludes that "for large signal-to-noise ratios, the MMSE canceller reduces to the *D*3 diagonalizer." *Id.* at 6.

*4. The Alleged Obviousness of Claim 30 in View of Gans, Adaptive Antennas, and Hsieh*

For the reasons discussed below, Petitioner has not shown a reasonable likelihood that it would prevail in establishing unpatentability of independent claim 30 as obvious over Gans, Adaptive Antennas, and Hsieh.

*a. Petitioner's Proposed Combinations*

A petition for *inter partes* review must identify "with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim." 35 U.S.C. § 312(a)(3); *see also* 37 C.F.R. § 42.104(b) (specifying necessary elements of a petition).

Patent Owner argues that Petitioner "vaguely asserts" that it would have been obvious to combine Gans, Adaptive Antennas ("Compton"), and Hsieh, "without explaining what the combination actually is." Prelim. Resp. 38 (emphasis omitted) (citing Pet. 34). Patent Owner further argues that "Petitioner fails to provide the required 'clear, evidence-supported account of the contemplated workings of the combination,' and fails to show how the combination meets all the claim elements." *Id.* at 38 (emphasis omitted) (quoting *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017). We agree with Patent Owner, and determine that Petitioner has not explained adequately how Petitioner proposes to combine the references' teachings and how the proposed combination would work. As in the *Personal Web* case, "a clear, evidence-supported account of the contemplated workings of the combination is a prerequisite to adequately explaining and supporting a conclusion that a relevant skilled artisan would have been motivated to make the combination and reasonably expect success in doing so." *Personal Web Techs., LLC*, 848 F.3d at 994. The Petition does not present such a clear account.

For this first ground, Petitioner does not identify clearly and adequately a single proposed combination of teachings of the three relied-on references that purportedly would result in the claimed subject matter as a whole. Rather, Petitioner addresses each limitation separately and, for some, argues that there are multiple alternatives as to how that one limitation, when considered in isolation, would have been obvious. Claim 30, generally speaking, follows a signal as it undergoes various processing steps from its receipt to the transmission of outputs to an XPIC. *See* Ex. 1001, 26:1–13. It was incumbent upon Petitioner to offer a cohesive and understandable

articulation as to how a proposed combination of references' teachings renders obvious that entire process flow from start to finish.[7] Such an articulation should have included, on the facts of this case, an explanation as to how a relied-on circuit[8] from a prior art reference would be compatible and work with the circuits relied on by Petitioner for the preceding and subsequent steps in the signal processing flow. Petitioner did not provide such an articulation, and this is reason enough to deny the Petition.

As an example, Petitioner argues that Gans (the '088 patent) discloses limitation 30.c—which recites "processing the optical signal by (i) separating the optical field of the optical signal into orthogonally polarized field components"—and then presents two more options as "alternative means for meeting this claim limitation." Pet. 36–39; Ex. 1001, 26:7–9. The first of the three options relies on Gans alone and involves optical separator 14 outputting either four or eight components (four for each of two optical signals, $O_1$ and $O_2$), depending on how one understands Petitioner's theory. Pet. 36–37; *see also id.* at 37 (listing eight components as the optical separator output in the form of "a set of four components for each [of two] signal[s]" but also arguing that "[t]hese four polarization components represent the [two] orthogonally polarized signals"); *id.* at 40 (arguing that "the collection of [four] photodetectors . . . receive[s] a

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[7] In some cases, a petitioner might acceptably offer and explain alternative positions within the same ground in an easily understood manner. Such is not the case here.

[8] We do not reach the issue of the proper interpretation of an "XPIC" and do not construe the claimed methods as limited to the use of circuitry. Here, we are referring to Petitioner's reliance, at least in part, on the prior arts' disclosure of circuitry.

collection of four components for each incoming signal O1 and O2."). The other two options involve outputting in-phase and quadrature phase components, with one option being a purported suggestion in Gans in combination with the knowledge of a person of ordinary skill in the art as purportedly "confirmed in the '211 patent itself." *Id.* at 37–38 ("Accordingly, a POSITA would recognize that, in such a coherent optical receiver, the conventional implementation would include such in-phase and quadrature phase components of the orthogonally polarized signals."). The other alternative option is the combination of Gans, Adaptive Antennas, and Hsieh, and apparently involves the substitution for Gans's optical separator 14, as utilized in the first option, with "a separator that provides for a set of two orthogonally polarized field components, wherein each set of components comprises an in-phase and a quadrature phase representation of the corresponding signal." *Id.* at 38–39 (citing Ex. 1004 ¶ 176; Ex. 1031 ¶ 15–18).

Petitioner's proposed combinations become even more difficult to understand when the in-process signal reaches the next limitation, 30.d, which recites "processing the optical signal by . . . (ii) routing each of the orthogonally polarized field components to a coherent optical receiver to produce a first output and a second output." Ex. 1001, 26:7–11. For this limitation, Petitioner lists the eight signal components of Gans and argues that "the orthogonally polarized field components (*i.e.*, (i) the four polarization components horizontal linear, 45 degree linear, right-hand circular, left-hand circular for each individual signal O1 and O2, respectively), or (ii) *alternatively*, in-phase and quadrature phase components as described above in the context of limitation 30.c are used to

generate outputs." Pet. 40 (emphasis added) (citing Ex. 1006, 3:32–48, 4:67–5:18; Ex. 1004 ¶ 181–183).

Petitioner, still addressing limitation 30.d, appears to offer two alternative options for the second option of limitation 30.c discussed above, the option involving a purported suggestion in Gans and that would "include such in-phase and quadrature phase components." *Id.* at 37, 40–41. Specifically, Petitioner argues that, "[w]hen so configured, the orthogonally polarized field components (*i.e.*, (i) the four polarization components horizontal linear, 45 degree linear, right-hand circular, left-hand circular, or (ii) *alternatively* the in-phase and quadrature phase components) are routed to a coherent optical receiver comprising at least a set of photodiodes, which would produce first and second outputs." *Id.* (emphasis added).

The last limitation of claim 30, which Petitioner labels 30.e, recites "processing the optical signal by . . . (iii) transmitting the first and second outputs to a cross polarization interference canceller (XPIC)." Ex. 1001, 26:7–13. Under the section heading "30.e," Petitioner contends that Gans discloses this limitation, specifically arguing that Gans "discloses transmitting the first and second outputs of the coherent optical receiver (*i.e.*, S1 and S2) to a cross polarization interference canceller (XPIC)," and referring to the "the four different polarization components" that are the output of the four photodetectors shown in Gans's Figures 1 and 4. Pet. 41–42; *see also id.* at 43 ("[T]he '088 patent discloses the claimed function of cancelling XPI."). The portions of the circuits of Figures 1 and 4 identified by Petitioner's annotations as an XPIC are differently configured, thus adding two downstream alternative options for the first option (Gans alone) discussed above for the "separating" limitation 30.c. Further, Petitioner,

under this "30.e" section heading, does not refer explicitly to the in-phase and quadrature phase components of the other two options of limitation 30.c. *See id.* at 41–42. Thus, it is not clear that the signal components of the second and third options of Petitioner's theory for the "separating" limitation 30.c are ever transmitted to an XPIC, as required by the claim.

Notwithstanding that Petitioner argues that Gans discloses the last limitation 30.e (transmitting the two outputs to an XPIC), Petitioner inserts another heading under claim 30 titled "Cross polarization interference canceller (XPIC)." *Id.* at 42. Under this heading, Petitioner offers even more options and alternatives, arguing, for example:

> The application of weighting coefficients (which are complex elements) by the combination of attenuators and adders (which are provided the weighting coefficients by the weight generating circuitry) of the '088 patent [Gans], in view of the coefficient generating algorithms of Adaptive Antennas *and/or* Hsieh, comprise the claimed XPIC. *Alternatively*, the incorporation of the filters disclosed in Hsieh for applying weighting coefficients, combined with the coherent optical receiver as disclosed in the '088 patent in view of Adaptive Antennas, also discloses the claimed XPIC.

*Id.* at 42–43 (emphasis added). Notably, Petitioner, in the block quote above, nests within one of the alternatives the phrase "and/or" when referring to which of two references are being relied on for the coefficient generating algorithms, thereby further increasing the number of possible alternatives. The Petition continues in a similar fashion, offering even more options. *See, e.g.*, *id.* at 43–44 ("Attenuators . . . either alone, or in conjunction with its corresponding adder 28 or 30, comprises a set of four filters); *id.* at 44 ("Indeed, to the extent that such filters are not expressly disclosed in the '088 patent, a POSITA would know to apply an arrangement of four filters as is disclosed in Hsieh Fig. 4 in place of the attenuator and

adder circuitry of the '088 patent optical receiver to provide the appropriate weighting of the polarization components."); *id.* at 47 ("Moreover, a POSITA reading Hsieh's description of an MMSE canceller, including its comparison with the D3 diagonalizer, would also understand how to adapt Figure 4 for MMSE cancellation in the context of the '088 patent, or alternatively, would know to implement the MMSE 'weight matrix' taught by Hsieh in equation 8.").

Petitioner's presentation of multiple alternatives without sufficient explanation as to how the multiple alternatives interact and the failure to clearly map evidence and argument to the language of the claim improperly shifts the burden of deciphering Petitioner's arguments onto Patent Owner and the Board. *See* 35 U.S.C. § 312(a)(3) (A petition may be considered only if it "identifies, in writing and with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim."); *see also* 37 C.F.R. § 42.104(b) (Listing certain elements that a petition must specify in the "statement of the precise relief requested for each claim challenged."); Consolidated Trial Practice Guide (Nov. 2019), available at https://www.uspto.gov/TrialPracticeGuideConsolidated, 39 ("[P]arties should avoid submitting a repository of all the information that a judge could possibly consider, and instead focus on concise, well-organized, easy-to-follow arguments supported by readily identifiable evidence of record.").

In view of these deficiencies as to the articulation of a basis for the ground, we determine that Petitioner has failed to demonstrate a reasonable likelihood of prevailing on its challenge to claim 30 as obvious over Gans, Adaptive Antennas, and Hsieh.

*b. Limitation 30.c*

The claim language that Petitioner labels as limitation 30.c recites "processing the optical signal by (i) separating the optical field of the optical signal into orthogonally polarized field components. *See* Pet., Appendix A.

As mentioned above, Petitioner presents three different alternative theories for this limitation. *See id.* at 36–39. The first option is that the limitation is disclosed by Gans (the '088 patent). *See id.* at 36–37. Patent Owner argues, and we agree, that Petitioner has not shown how Gans discloses the limitation. Prelim. Resp. 52–53.

Petitioner initially asserts that Gans's optical separator 14 performs the recited step of separating the optical field into orthogonally polarized field components. *See* Pet. 36 ("The '088 patent discloses the use of an optical separator 14 to separate the optical field of the optical signal into orthogonally polarized field components."). However, Petitioner's articulated basis does not support that proposition. Petitioner argues that optical separator 14 receives an "optical signal compris[ing] two polarized field components ($O_1$ and $O_2$)" and, citing only the Abstract, contends that "the '088 patent [Gans] confirms that these two signals are orthogonal to one another." *Id.* at 35–36 (citing Ex. 1006, Abstract). Petitioner further argues:

> The optical separator separates the incoming optical signal into a plurality of respective polarization components that *correspond to the orthogonally polarized optical signals* O1 and O2 . . . .
>
> Accordingly, each of the two orthogonally polarized optical signals (O1 and O2 . . . are, after the optical separator, separated into a set of four components for each signal (components $O_{1h}$, $O_{1f}$, $O_{1r}$, and $O_{1l}$ for signal O1; and components $O_{2h}$, $O_{2f}$, $O_{2r}$, and $O_{2l}$ for signal O2). These four polarization components *represent the orthogonally polarized*

> *signals* transmitted across the fiber, and thus meets thus limitation. EX1004, ¶173.

*Id.* at 37. In other words, Petitioner argues that optical separator 14 outputs four components[9] that "represent" or "correspond" to the purportedly orthogonally polarized inputs. However, as Patent Owner notes (Prelim. Resp. 53), the claim language does not contain such qualifiers and calls for the separated field components themselves to be orthogonally polarized. Petitioner does not explain adequately how Gans discloses the optical field that is input to optical separator 14 being "separat[ed] . . . into orthogonally polarized field components," as required by claim 30.

Petitioner also offers two alternative theories for this limitation 30.c. *See* Pet. 37–39. Both involve, to the extent we understand Petitioner's theories, a splitter or separator that provides "an in-phase and a quadrature phase representation of the corresponding signal." Pet. 39 (Petitioner's third option); *see also id.* at 37 (Petitioner's second option: "the conventional implementation would include such in-phase and quadrature phase components of the orthogonally polarized signals."). We determine that neither of these alternative theories leads to a conclusion that Petitioner has demonstrated a reasonable likelihood of prevailing in its challenge.

First, Petitioner, in articulating these theories, makes several assertions without a clear mapping to the actual language of the limitation. For example, we understand Petitioner, for one alternative, to argue that Gans provides an express suggestion to modify the system of the option of Petitioner's first theory to provide for "coherent detection." *See id.* at 37

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[9] Gans identifies the four polarization components as: "horizontal linear (including $O_{1h}$ and $O_{2h}$), 45 degree linear ($O_{1f}$ and $0_{2f}$), right-hand circular ($O_{1r}$ and $O_{2r}$), and left-hand circular ($O_{1l}$ and $O_{2l}$)." Ex. 1006, 3:32–37.

(quoting Ex. 1001, 7:10–14). Petitioner, in the next sentence, argues: "Accordingly, a POSITA would recognize that, in such a coherent optical receiver, the conventional implementation would include such in-phase and quadrature phase components of the orthogonally polarized signals." *Id.* (citing Ex. 1004 ¶ 174; Ex. 1031 ¶ 14–18). This is followed by an argument as to how the challenged patent's discussion of a prior art system purportedly "confirm[s]" the immediately preceding "Accordingly" assertion. *Id.* at 38. Petitioner does not tie clearly the claim's requirement of "separating the optical field . . . into orthogonally polarized field components" to the assertion that "the conventional implementation would *include* such in-phase and quadrature phase components of the orthogonally polarized signals." *See id.* at 37–38 (emphasis added). Thus, we are unable to discern the basis for Petitioner's apparent contention that "includ[ing]"—at some unidentified step of the process—in-phase and quadrature phase components of signals equates to the step of separating the field into orthogonally polarized field components prior to routing those field components to a coherent optical receiver, the outputs of which are transmitted to an XPIC, as required by claim 30. *See* Ex. 1001, 26:7–13 (Claim 30: "processing the optical signal by (i) separating . . ., (ii) routing . . ., and (iii) transmitting the first and second outputs to a cross polarization interference canceller (XPIC).").

Second, as mentioned above, Petitioner, under the heading "30.e" for the "transmitting" limitation, does not use the words "in-phase and quadrature phase components," and appears to contend that the proposed combination(s) involve only the transmission of Gans's "four different polarization components." *See* Pet. 41–42; *see also id.* at 41 (arguing that

Gans alone discloses the limitation in asserting that: "The '088 patent discloses transmitting the first and second outputs of the coherent optical receiver (i.e., S1 and S2) to a cross polarization interference canceller (XPIC)."). Thus, even if Petitioner presented viable alternatives for the disclosure of the "separating" limitation 30.c, we are unable to recognize the articulation of an overall and complete embodiment where those two "in-phase and quadrature phase" alternatives are utilized.

We determine that Petitioner has not demonstrated a reasonable likelihood of demonstrating that its relied-on references disclose or suggest the "separating" step as recited in claim 30.

*5. Petitioner's Challenge to The Remaining Claims of Ground 1*

Petitioner also alleges that dependent claim 32 and independent claims 33, 35, and 37 would have been obvious over Gans, Adaptive Antennas, and Hsieh. *See* Pet. 52–58. Independent claims 33, 35, and 37 pertain to the specific way that cross polarization interference is mitigated or eliminated.

*a. Dependent Claim 32*

Claim 32 depends from independent claim 30, and Petitioner's discussion of claim 32 does not cure the underlying defects of the challenge to claim 30. *See id.* at 52.

*b. Independent Claim 33*

Claim 33 recites "mitigating cross polarization interference associated with the at least two modulated polarized field components to reconstruct the information bearing waveforms using a plurality of matrix coefficients being complex values to apply both amplitude scaling and phase shifting to the at least two modulated polarized field components." Ex. 1001, 26:25–30.

Petitioner's articulation of proposed combination(s) for independent claim 33 is, like that discussed above for claim 30, difficult to follow. *See* Pet. 52–56. Petitioner breaks into two parts the "mitigating" limitation, and argues, in part:

> The "mitigating cross polarization interference associated with the at least two modulated polarized field components" *is disclosed for the same reasons as limitation 30.e in the context of the various MMSE disclosures of Adaptive Antennas and Hsieh*, wherein XPI associated with the polarized field components (i.e., the collection of $O_1$ and $O_2$ components, respectively)[] is mitigated. EX1004, ¶216. *As shown above, the MMSE disclosures of Adaptive Antennas and Hsieh teach the use of an XPIC*, which is one mechanism for mitigating XPI. *See analysis of limitations 30.d, 30.e, 35.d, and 35e* ("mitigation of the cross polarization interference is accomplished through a matrix multiplication using a cross polarization interference canceler that produces the recovered signals with the minimum mean square error (MMSE)").

Pet. 53 (emphasis added).

Assuming Petitioner is referring us to the sections of the Petition under both the "30.e" and "Cross polarization interference canceller (XPIC)" headings[10], Petitioner is asking us and Patent Owner to search eleven pages of argument, which includes alternatives nested within alternatives, for arguments concerning "the various MMSE disclosures of Adaptive Antennas and Hsieh." *See* Pet. 41–51. Adding to the difficulty of discerning the proposed combination, Petitioner also asks the reader to "[s]ee analysis of limitations 30.d, 30.e, 35.d, and 35e" apparently for arguments in support of the proposition that "the MMSE disclosures of

[10] The section under the heading "30.e" contains only the contention that Gans discloses the limitation, and does not include a mention of any "MMSE disclosures of Adaptive Antennas and Hsieh." Pet. 41–42.

Adaptive Antennas and Hsieh teach the use of an XPIC, which is one mechanism for mitigating XPI." *Id.* at 53 (italicizing omitted).

For the recited "matrix coefficients," Petitioner appears to propose alternatives from each of three relied-on references. *See id.* at 54 ("The '088 patent [Gans] discloses the use of 'weighting vectors' that comprise a plurality of coefficients . . . [and a] POSITA would have understood at the time of the '211 patent inventions that a plurality of such weighting vectors comprises a matrix," and "[f]urther, Adaptive Antennas and Hsieh teach the use of matrix coefficients being complex values to apply both amplitude scaling and phase shifting.").

As with claim 30, Petitioner has not explained the bases for its challenge to claim 33 with adequate specificity and particularity, and has not demonstrated a reasonable likelihood of prevailing on its challenge to independent claim 33 as being obvious over Gans, Adaptive Antennas, and Hsieh.

*c. Independent Claims 35 and 37*

Claim 35 recites "mitigating cross polarization interference" using an XPIC "that produces the recovered signals with the minimum mean square error (MMSE) relative to the desired transmitted signals." Ex. 1001, 26:46–51. Petitioner offers little or no new analysis for the limitations of claim 35 and portions thereof but, rather, cross-references multiple other sections of the Petition, some of which are further cross-references. Pet. 56–57; *see id.* at 56 (stating, for "35.c," "The '088 patent in combination with Adaptive Antennas and Hsieh discloses this limitation as discussed above in the context of limitation 30.e, 33.c and in 35.d and 35.e below."); *id.* at 57 (stating, for "35.d," which itself is the destination of a cross-reference in 35.c, "As discussed in connection with limitation 30.e and 33.d, the '088

patent (in combination with Adaptive Antennas and Hsieh, teaches matrixes of weighting vectors . . . .")).

In independent claim 37, "the elimination of the cross polarization interference is accomplished through matrix multiplication using a diagonalizer cross polarization interference cancellation network being a general inverse of a transmission matrix associated with the transmitter and the single fiber optic transmission medium." Ex. 1001, 28:1–7. Petitioner again offers little or no new analysis for the limitations of claim 37, instead utilizing cross-references to various other sections of the Petition. *See* Pet. 57–58; *see also id.* at 58 (stating, for "37.d," "The '088 patent and Hsieh disclose these claim elements for the same reasons as disclosed in 30.e, and further for the reasons discussed in 37.e below.").

Although utilizing internal cross-references might be acceptable in some cases, here the cross-referencing to multiple sections that lack specificity and particularity further obscures whatever proposed combination Petitioner relies on as rendering obvious the respective challenged claim as a whole.

Petitioner has not demonstrated a reasonable likelihood of prevailing on its challenge to independent claim 35 or independent 37 as being obvious over Gans, Adaptive Antennas, and Hsieh.

### *E. The Alleged Obviousness of Claims 30 and 32 Over Gans, Adaptive Antennas, Hsieh, and Betti '628*

Petitioner alleges that independent claim 30 and its dependent claim 32 would have been obvious over Gans, Adaptive Antennas, Hsieh, and Betti '628. *See* Pet. 58–65.

In this second ground, Petitioner builds on the flawed foundation of the first ground, relying on much of its analysis from the first ground based

on Gans, Adaptive Antennas, and Hsieh. *See, e.g.*, Pet. 62 ("Limitations 30pre, 30.a, 30.b, and 30.e are met for the same reasons as discussed above in the context of the corresponding limitations of claim 30, Ground 1, which discussion is incorporated herein by reference." (emphasis omitted)). As Patent Owner notes (Prelim. Resp. 68), Petitioner does not rely on Bette '628 for limitation 30.e, which requires transmitting the outputs to an XPIC, instead choosing to rely on its arguments made for the first ground.

Petitioner argues that a person of ordinary skill in the art "would have been motivated to combine these [Ground 1] references (and in particular, the '088 patent [Gans]) with the coherent optical receiver architecture of the [Bette] '628 patent." *Id.* at 58–59 (citing Ex. 1004 ¶ 237); *see id.* at 61 ("Combining the '628 patent coherent receiver architecture with the '088 patent–Adaptive Antennas-Hsieh system would also have yielded a reasonable expectation of success.").

As an initial matter, it is not clear as to which of the many possible proposed combinations of Gans, Adaptive Antennas, and Hsiah is or are being modified by the teachings of Bette '628. Without that important aspect, we cannot begin to assess Petitioner's reasoning to modify a combination or determine whether a proposed combination teaches or suggests every limitation as arranged in the claim.

Complicating matters, Petitioner's inclusion of a fourth reference in this ground adds even more alternative combinations. As mentioned above, Petitioner presents, for the first ground, three different alternative theories for the "separating" limitation 30.c. *See id.* at 36–39. For this second ground, Petitioner argues that limitation 30.c is met for the same reasons given for the first ground and adds another alternative, arguing that,

"[a]dditionally, the '088 patent-Adaptive Antennas-Hsieh system combined with the '628 patent's coherent receiver architecture discloses this limitation." *Id.* at 62 (citing Ex. 1004 ¶ 245). Similarly, for limitation 30.d, Petitioner argues that the limitation is met by its proposed alternatives of the first ground before adding another alternative, arguing "[a]dditionally, the '088 patent-Adaptive Antennas-Hsieh system combined with the '628 patent's coherent receiver architecture discloses this limitation." *Id.* at 63 (citing Ex. 1004 ¶¶ 248–249).

Further, following one path of the possible alternatives of this second ground seemingly would result in Petitioner relying solely on the combination of the first ground, thus leaving unclear the role of Betti '628 in the ground. Specifically, Petition argues:

> Limitations 30pre, 30.a, 30.b, and 30.e are met for the same reasons as discussed above in the context of the corresponding limitations of claim 30, Ground 1[.] . . . Limitation 30.c is likewise met for the same reasons as discussed above in the context of limitation 30.c, Ground 1. . . . Limitation 30.d is likewise met for the same reasons as discussed above in the context of limitation 30.d, Ground 1.

Pet. 62–63 (bolding omitted).

In view of the deficiencies regarding the articulation of a basis for the second ground, we determine that Petitioner has failed to demonstrate a reasonable likelihood of prevailing on its challenge to claim 30, or its dependent claim 32, as obvious over Gans, Adaptive Antennas, Hsieh, and Bette '628.

### *F. Discretion Under 35 U.S.C. §§ 314(a) and 325(d)*

This is the third *inter partes* review challenging the '211 patent, and institution was denied in the prior two cases. *See* Pet. 65–66; Prelim.

Resp. 1. Patent Owner contends the Board should exercise its discretion under 35 U.S.C. § 314(a) and deny the present Petition, arguing that "fairness and efficiency dictate that [Patent Owner] Core not face a trial on this third attempt at review, which recycles the same art and arguments as the prior petitions." Prelim. Resp. 24–26. Patent Owner also contends the Board should exercise its discretion under 35 U.S.C. § 325(d) and deny the Petition, arguing that the same or substantially the same prior art previously were presented to the Office and considered either by the Examiner during prosecution of the application or by the Board in one of the two prior *inter partes* reviews. *See id.* at 26–32. Petitioner contends that discretionary denial under § 314(a) or § 325(d) is not warranted. Pet. 66–76. Because we are denying the Petition on the merits, we need not determine whether it would be appropriate to deny the Petition under 35 U.S.C. §§ 314(a) or 325(d).

## III. CONCLUSION

Petitioner has not demonstrated that there is a reasonable likelihood of establishing the unpatentability of any of claims 30, 32, 33, 35, and 37 of the '211 patent.

## IV. ORDER

For the foregoing reasons, it is

ORDERED that the Petition is *denied* and no trial is instituted.

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